2023 Pretty Lady #1 Friction Calculations (Hazen-Williams Correlation)

Material	Hazen-Williams Coefficient - c -
Plastic	130 - 150
Polyethylene, PE, PEH	140
Polyvinyl chloride, PVC, CPVC	150
Smooth Pipes	140
Steel new unlined	140 - 150
Steel, corrugated	60
Steel, welded and seamless	100
Steel, interior riveted, no projecting rivets	110
Steel, projecting girth and horizontal rivets	100
Steel, vitrified, spiral-riveted	90 - 110
Steel, welded and seamless	100

Fluid Flow Friction Loss - Hazen-Williams Coefficients (engineeringtoolbox.com)

$$F = \frac{2.083\left(\frac{100}{C}\right)^{1.852}(Q)^{1.852}}{ID^{4.8665}}$$

F: Friction Losses (feet/1000 feet)
C: Pipe Coefficient
Q: Flow Rate (GPM)
ID: Tubing Inside Diameter (inches)

Pipe Size	Weight	ID
2-7/8"	10.40#	2.151
3-1/2"	9.3#	2.990
4.5"	13.75#	3.958
5.5"	17#	4.892

Epoxy Coating 8 mils TK-2
0.016 inch reduction in ID

Friction Calculations:

6 bbl/m

C	Length	OD	ID	Rate gal/m	ft H2O/1000ft	ft H2O	PSI	Sum
Original 2006 Configuration (5-1/2")								
94	3687	5.5"	4.876	252	29.38	108.3	46.96	
94	10.44	6" Locator	4.750	252	33.37	0.3	0.15	
94	10.26	6" Packer SB	6.000	252	10.71	0.1	0.05	
94	0.65	4-1/2" Pump out	3.880	252	89.31	0.1	0.03	
94	17.66	4.5"	4.000	252	77.01	1.4	0.59	47.78
New 2023 Configuration (4-1/2")								
94	3612.94	4.5"	3.942	252	82.68	298.7	129.50	
94	21.88	3-1/2"	2.990	252	317.30	6.9	3.01	
94	2.28	SN (2.81)	2.810	252	429.21	1.0	0.42	
94	1.75	3-1/2" On/Off	3.700	252	112.53	0.2	0.09	
94	0.95	3-1/2" XN	2.580	252	650.30	0.6	0.27	
94	10.44	6" Locator	4.750	252	33.37	0.3	0.15	
94	10.26	6" Packer SB	6.000	252	10.71	0.1	0.05	133.49

Added to the Injection String 2023
Still in wellbore configuration from 2006

85.71 Net Friction Increase

C (match 2006 SRT data)		1405.71

2006 Step Rate Test		
Avg. Hydrostatic	1629	
Inflection Point	2980	psi BH
Surface Pressure (Inflection Point)	1399	
Average Friction (Measured)	48	psi @ 6 bpm

5-1/2" Operating Parameters		
Surface Inj. Pressure	1320	psi
Surface Inj. Pressure limit	1350	psi

4-1/2" Operating Parameters		
New Friction	133.49	psi @ 6 bpm
New Inflection point (Surface)	1484	psi
Inflection Point Bottomhole	2980	psi BH
New Surface Injection Pressure Limit	**1436**	psi

Requested MSIP	**1435**	**psi**

From: Gebremichael, Million, EMNRD
To: Ryan Davis
Cc: Goetze, Phillip, EMNRD; Chavez, Carl, EMNRD; Shacie Murray; Ryan Merrion; Jeff Davis; Philana Thompson; Harris, Anthony, EMNRD
Subject: RE: [EXTERNAL] Re: OCD SRT Guidance Questions Communication Meeting
Date: Friday, September 1, 2023 3:14:43 PM
Attachments: image001.png
image002.png
image003.png

Hello Ryan,
Thank you for the friction pressure calculation. OCD will prepare IPI order based on compensating the friction increase due to the smaller ID tube, with some condition of approval to ensure that injecting under the new pressure will not exceed the pressure that was determined by the 2006 SRT result.

The time live for the IPI order will be sometime next week.
Thanks,

Million Gebremichael

Petroleum Specialist- A
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505
Cell : 505-4791137

From: Ryan Davis <rdavis@merrion.bz>
Sent: Thursday, August 31, 2023 3:54 PM
To: Gebremichael, Million, EMNRD <Million.Gebremichael@emnrd.nm.gov>
Cc: Goetze, Phillip, EMNRD <phillip.goetze@emnrd.nm.gov>; Chavez, Carl, EMNRD <Carlj.Chavez@emnrd.nm.gov>; Shacie Murray <shacie@merrion.bz>; Ryan Merrion <ryan@merrion.bz>; Jeff Davis <jdaguamoss@hotmail.com>; Philana Thompson <pthompson@merrion.bz>
Subject: Re: [EXTERNAL] Re: OCD SRT Guidance Questions Communication Meeting

Million,

My apology for the delay in getting the friction calculations to you on the Pretty Lady #1.

I have attached a letter requesting an increase in our MSIP as well as the 2006 SRT data and friction calculations analysis. Please let us know if you have any questions.

I will be out of the office starting tomorrow through September 11th. Shacie Murray is familiar with the friction calculations and should be able to answer any questions you may have.

Thanks,

Ryan Davis

Operations Manager

MERRION OIL & GAS

(W) 505-215-3292

From: Gebremichael, Million, EMNRD <Million.Gebremichael@emnrd.nm.gov>
Sent: Thursday, August 10, 2023 2:13 PM
To: Ryan Davis <rdavis@merrion.bz>
Cc: Goetze, Phillip, EMNRD <phillip.goetze@emnrd.nm.gov>; Chavez, Carl, EMNRD <Carlj.Chavez@emnrd.nm.gov>
Subject: RE: [EXTERNAL] Re: OCD SRT Guidance Questions Communication Meeting

Ryan,
Thank you for your honesty. It was little confusing to request for second SRT on same rock .

The way forward with this is that please submit your friction loss calculation and UIC will consider your IPI application for compensation of pressure loss due to friction.

Thanks,

Million Gebremichael

Petroleum Specialist- A
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505
Cell : 505-4791137

From: Ryan Davis <rdavis@merrion.bz>
Sent: Thursday, August 10, 2023 2:01 PM
To: Gebremichael, Million, EMNRD <Million.Gebremichael@emnrd.nm.gov>

Cc: Goetze, Phillip, EMNRD <phillip.goetze@emnrd.nm.gov>; Chavez, Carl, EMNRD <Carl.Chavez@emnrd.nm.gov>
Subject: Re: [EXTERNAL] Re: OCD SRT Guidance Questions Communication Meeting

Million,

To be honest we do not want to perform another SRT on the MV interval. As I mentioned during our Teams discussion, we cemented a 7" liner inside of the 9-5/8". With the smaller ID in the 7" liner we had to run a smaller injection string. We want to increase our surface injection pressure to compensate for the additional friction from the smaller injection string. I prefer to take my calculated friction, which is history matched to previous actuals, and utilize the data from the past two SRT to request an increase in the Maximum Allowable Surface Injection Pressure.

Thanks,

Ryan Davis

Operations Manager

MERRION OIL & GAS

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From: Gebremichael, Million, EMNRD <Million.Gebremichael@emnrd.nm.gov>
Sent: Thursday, August 10, 2023 12:47 PM
To: Ryan Davis <rdavis@merrion.bz>
Cc: Goetze, Phillip, EMNRD <phillip.goetze@emnrd.nm.gov>; Chavez, Carl, EMNRD <Carl.Chavez@emnrd.nm.gov>
Subject: RE: [EXTERNAL] Re: OCD SRT Guidance Questions Communication Meeting

Ryan,

SWD 1034A was issued as an amendment to the previous one to allow the well to inject into MV (3762-3830') and due to the elimination of shallower formations for injection (Morrison/Entrada), OCD reduced the injection pressure and In order to increase surface injection pressure, SRT was conducted on MV and OCD approved an increase of surface injection pressure under the IPI 278 based on SRT results. You have noted the SRT result in your submission as :

Well Data:
- Frac Gradient: **0.79 psi/ft** (2006 Step Rate)
- Pressures:
  - April 20th-27th 2023: Shut in prior to WO
    - 5 day: 1030 psi
    - 48 hours: 1069 psi
    - 12 hours: 1085 psi
    - 2 hours: 1110 psi
    - Injection pressure 1330 psi

My question is why do you need to conduct another SRT on MV?
Thanks,

Million Gebremichael

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Santa Fe, New Mexico 87505
Cell : 505-4791137

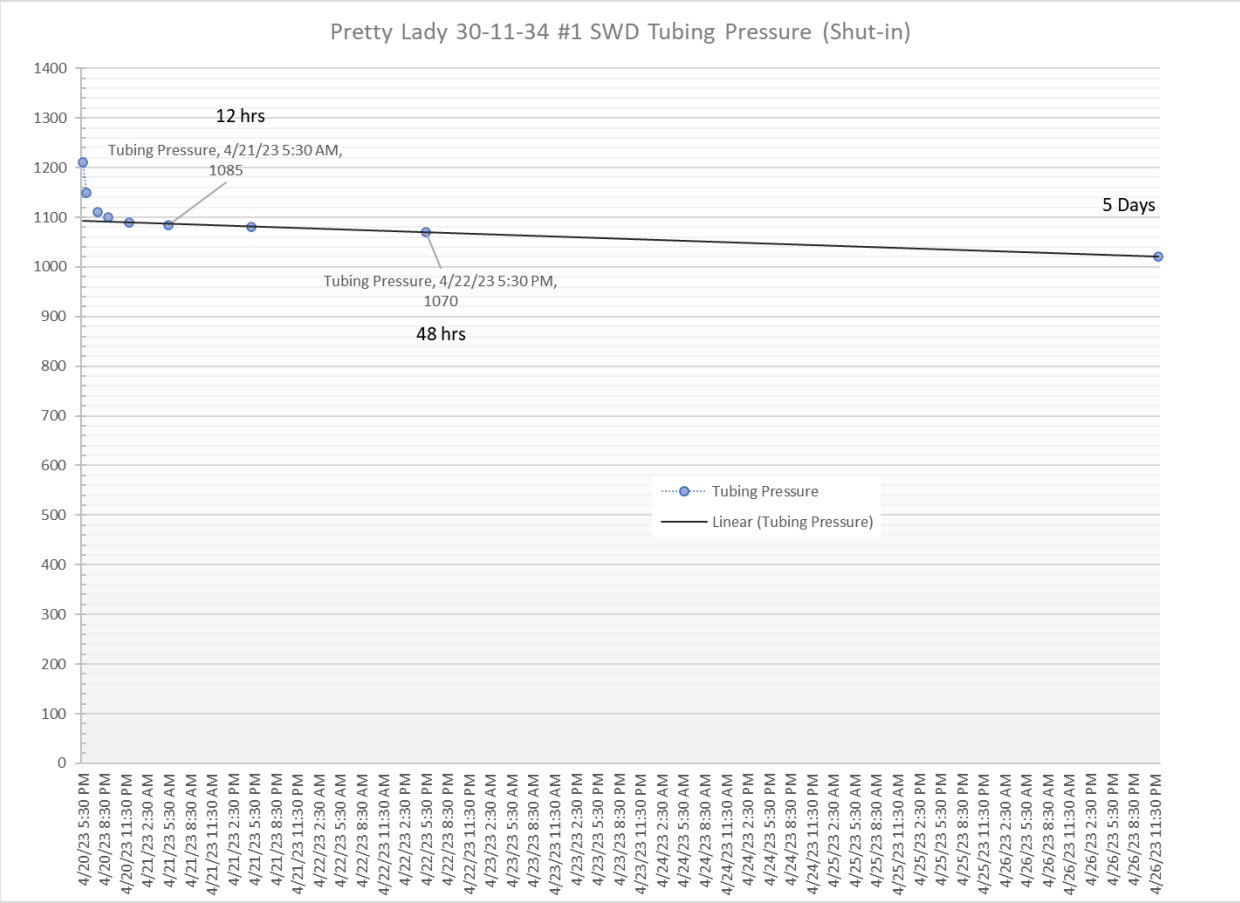
From: Ryan Davis <rdavis@merrion.bz>
Sent: Friday, August 4, 2023 2:05 PM
To: Chavez, Carl, EMNRD <Carl.Chavez@emnrd.nm.gov>; Gebremichael, Million, EMNRD <Million.Gebremichael@emnrd.nm.gov>
Cc: Goetze, Phillip, EMNRD <phillip.goetze@emnrd.nm.gov>; Philana Thompson <pthompson@merrion.bz>; Shacie Murray <shacie@merrion.bz>; Jeff Davis <jdaguamoss@hotmail.com>
Subject: [EXTERNAL] Re: OCD SRT Guidance Questions Communication Meeting

Carl, et al.,

Good afternoon!

I am attaching the procedure for the proposed SRT on the Pretty Lady 30-11-34 #1 Class II SWD. We have submitted a NOI through the e-Permitting system with the Submission ID: 248408.

We have modified the procedure to align with the NMOCD guidance. We understand the need for consistency from the NMOCD and have extended our step interval to 30 min as this is consistent with the EPA Region 8 guidance. We are, however, proposing a 12-hour shut-in period instead of the required 48 hours. The MV interval that we are injecting into is very permeable. We believe that shutting in 12 hrs is a reasonable period for the bottom hole pressure to approximate shut-in formation pressure. The rate of pressure change that we have observed between 12 and 48 hours is less than 0.5 psi/hour and similar out to 5 days. The MV interval is continuous throughout the basin and therefore behaves as an infinite reservoir. The pressure will continue to leak off within the reservoir over time. We believe 12 hours is a suitable time frame for the bottom hole pressure to approximate a shut-in formation condition. Below is a chart illustrating the pressure fall-off during our most recent shut-in period. The 12 hour pressure was 1085 psi, 48 hour 1070 psi and 5 day 1030 psi. Referring back to the EPA Region 8 guidance it states that the well should be shut in long enough prior to testing such that the bottom hole pressures approximate shut-in formation pressures.



Please let me know if you have any questions or concerns. We appreciate your time and consideration.

Thanks,

Ryan Davis

Operations Manager

MERRION OIL & GAS

(W) 505-215-3292

From: Chavez, Carl, EMNRD
Sent: Monday, July 31, 2023 4:07 PM
To: Chavez, Carl, EMNRD <Carl.Chavez@emnrd.nm.gov>; Gebremichael, Million, EMNRD <Million.Gebremichael@emnrd.nm.gov>; Philana Thompson <pthompson@merrion.bz>; Ryan Davis <rdavis@merrion.bz>
Cc: Goetze, Phillip, EMNRD <phillip.goetze@emnrd.nm.gov>
Subject: OCD SRT Guidance Questions Communication Meeting
When: Tuesday, August 1, 2023 1:30 PM-2:30 PM.
Where: Microsoft Teams Meeting

Microsoft Teams meeting

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CONDITIONS

Action 274678

CONDITIONS

Operator: NEW MEXICO ENERGY MINERALS & NATURAL RESOURCE 1220 S St Francis Dr Santa Fe , NM 87504	OGRID: 264235
	Action Number: 274678
	Action Type: [IM-SD] Admin Order Support Doc (ENG) (IM-AAO)

CONDITIONS

Created By	Condition	Condition Date
pgoetze	None	10/11/2023